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GEOTECHNICAL INVESTIGATION
PROPOSED STORMWATER BASIN ENHANCEMENT PROJECT
CITY OF TORRANCE, COUNTY OF LOS ANGELES, CALIFORNIA

PREPARED FOR:

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CTE JOB NO. 40-2685 **MAY 18, 2011**

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

This geotechnical report was performed to provide site-specific geotechnical information for the proposed development located in Torrance, California. The proposed development is understood to consist of improvements to three basins, named Amie Basin, Henrietta Basin, and Entradero Basin. Enhancements to these basins will include passive wetland treatment, additional retention and infiltration, groundwater recharge and habitat restoration. Details of the proposed improvements are discussed in Section 2.0 of this report.

Based on our investigation and review of geologic maps, the site is underlain by alluvial flood plain deposits. During our investigation, perched groundwater was encountered at the Amie Basin site at depths of 3 to 4 feet below ground surface. Groundwater was not encountered at the Henrietta and Entradero basin sites. Groundwater levels will likely fluctuate during periods of high precipitation. Groundwater should be expected to impact the proposed development at Amie Basin. At the Henrietta and Entradero basins, grading or construction could be adversely affected by saturated subgrade conditions if performed during or following periods of wet weather.

The subject sites are located approximately 2 to 2½ miles northeast east of the Palos Verdes fault. Based on our investigation and geologic literature review, the sites are not traversed by an active fault. Therefore, the potential for on-site fault displacement occurring during the useful life of the structures should be considered low.

Based on our investigation, the proposed development is considered feasible from a geotechnical standpoint, provided the recommendations herein are implemented during project design and construction.

2.0 INTRODUCTION AND SCOPE OF SERVICES

2.1 Introduction

Construction Testing and Engineering, Inc. (CTE) has prepared this report for California Watershed Engineering. Presented herein are the results of the subsurface investigation performed as well as recommendations regarding the geotechnical engineering and dynamic loading criteria for the proposed improvements.

The proposed development is understood to consist of improvements at three basin locations, named Amie Basin, Henrietta Basin, and Entradero Basin. Enhancement to these basins will include passive wetland treatment, additional retention and infiltration, groundwater recharge and habitat restoration.

Improvements at the Amie Basin will include enhancement of an approximately 2-acre wetland for stormwater retention, treatment and infiltration, a new approximately 1,000 square-foot infiltration basin, a new access road using recycled materials, new sump pump and irrigation lines, new trash interceptors at each storm drain inlet, relocation of existing pumps, new force main piping, and a future pump house.

Improvements at the Henrietta Basin will include enhancement of a 3-acre wetland for stormwater retention, treatment and infiltration, use of an existing approximately 1,240 square-foot infiltration basin, modifications to existing Herondo Drain inlet, new and reconstructed access roads using recycled materials, new sump pump and irrigation lines, new trash interceptors at each storm drain inlet, and three viewing areas.

Improvements at the Entradero Basin will include use of an existing approximately 15,000 square-foot infiltration basin, modifications to existing Herondo Drain inlet, reconstruction of existing walking paths and access roads using recycled materials, a new pedestrian bridge, a new vehicle access bridge, a new rock-walled berm and sediment basin, new trash interceptors at remaining storm drain inlets, new irrigation system for baseball fields, raising the main baseball field, and a new viewing platform.

2.2 Scope of Services

Our scope of services included:

- Review of readily available geologic and geotechnical literature pertinent to the site.
- Explorations to determine subsurface soil, rock, and groundwater conditions to the depths influenced by the proposed development.
- Perform infiltration testing using ASTM Standard D 3385 (double-ring infiltrometer), two tests at each basin location.
- Laboratory testing of representative soil samples to provide data to evaluate the geotechnical design characteristics of the site foundation soils.
- Definition of the general geology and evaluation of potential geologic hazards at the site.

- Preparation of this report detailing the investigation performed and providing conclusions and geotechnical engineering recommendations for design and construction. Included in the report are site geology and hazards, seismic effects and design parameters, earthwork recommendations, foundation design parameters including lateral resistance, and infiltration test results.

3.0 SITE LOCATION AND DESCRIPTION

The Amie Basin site is located on the north side of Spencer Street, west of Madison Street. The Henrietta Basin site is located on the west side of Henrietta Street, north of Edgemere Drive and south of Sara Drive. The Entradero Basin site is located within Entradero Park, which is located south of Towers Street, west of Sturgess Drive and north of Halison Street. Figure 1 shows the location of the three basin sites.

The Amie Basin site currently contains a pond and marsh land, and a secondary pond where water is pumped to a storm drain outlet. The basin has three storm drain inlets and a partially asphalt-paved access road running along the southern portion of the site. The upper portion of the basin walls are steep-sloped (approximately 1.2 to 1 horizontal to vertical, and approximately 25-feet in height) and are concrete-lined.

The Henrietta Basin site currently consists of an elongated marsh land with an outlet structure at its northern end. The basin has four storm drain inlets and a gravel access road running along the eastern perimeter of the site.

The Entradero Basin is within a park, which contains ball fields and walking trails. The basin is located in the northern portion of the park and is vegetated with tall grasses and shrubs. The basin contains an outlet structure, three storm drain inlets, and an earthen channel inlet.

4.0 FIELD AND LABORATORY INVESTIGATION

4.1 Field Investigation

Our field investigation was performed on April 19, 2011 and included eight (8) exploratory borings identified as B-1 thru B-8. Borings B-1, B-2, B-7, and B-8 were conducted at Amie basin, borings B-3 and B-4 at Henrietta basin, and B-5 and B-6 at Entradero basin. The exploration locations are shown on Figures 2A thru 2C.

The explorations were excavated to investigate and obtain samples of the subsurface soils. The borings were excavated using a truck-mounted, eight-inch diameter, hollow-stem auger drill rig to a maximum explored depth of 26½ feet below the existing surface.

Soils encountered within the explorations were classified in the field in accordance with the Unified Soil Classification System. The field descriptions were later modified (as appropriate) based on the results of our laboratory-testing program. In general, soil samples were obtained at 2- to 5-foot intervals with standard split spoon (SPT and California Modified) samplers. Specifics of the soils encountered can be found in the Exploration Logs, which are presented in Appendix B.

The field investigation included infiltration testing at each basin location (two tests per basin). The infiltration tests were performed in accordance with County of Los Angeles guidelines (2011) using a double-ring infiltrometer (ASTM D3385). The tests were conducted in the proposed or existing infiltration basin areas until stabilized infiltration rates were achieved. Test results are presented in Section 6.6 and test locations are presented on Figures 2A thru 2C.

4.2 Laboratory Analyses

Laboratory tests were conducted on representative soil samples to evaluate their physical properties and engineering characteristics. Specific laboratory tests included: in-place moisture and density, expansion index, Atterberg limits, gradation, and chemical analyses. These tests were conducted to determine the physical properties and corrosivity of the on-site soils. Test method descriptions and laboratory results are presented in Appendix C.

5.0 GEOLOGY

5.1 General Physiographic Setting

The subject sites lie within the Los Angeles Basin portion of the Transverse Ranges geomorphic province. The Transverse Ranges, unlike the rest of California, form an east-west trending unit. The San Andreas fault system forms the northern boundary of the province. The province subdivides into individual ranges separated by alluviated, broad synclinal valleys, narrow stream canyons, and faults (Webb and Norris, 1990).

5.2 Site Geologic Conditions

Based on our investigation and geologic mapping (Saucedo et al, 2003), the sites are underlain by alluvial flood plain deposits. Artificial fill material was encountered at the Amie basin site. Below is a brief description of the soils encountered during the investigation. More detailed descriptions are provided in the Exploration Logs in Appendix B.

5.2.1 Artificial Fill

Artificial fill was encountered at the Amie basin in borings B-1, B-2, and B-7. The artificial fill ranged between approximately 1 and 2 feet in thickness, and consisted of miscellaneous base material and silty clayey sand.

5.2.2 Young Alluvial Flood Plain Deposits (Qya)

Young alluvial flood plain deposits were encountered at the Henrietta and Entradero basins in borings B-3 thru B-6 from the surface to the maximum explored depth of 21½ feet. The deposits consisted of layers of loose to very dense silty sand and poorly-graded sand with silt.

5.2.3 Old Alluvial Flood Plain Deposits (Qoa)

Old alluvial flood plain deposits were encountered at the Amie basin in borings B-1, B-2, B-7 and B-8 from the surface (or below the artificial fill) to the maximum explored depth of 26½ feet. The deposits consisted of layers of very loose to very dense silty clayey sand and poorly-graded sand with silt and stiff to hard fat clay and sandy silt.

5.3 Groundwater Conditions

Perched groundwater above a layer of low permeability clay was encountered at the Amie basin in borings B-1, B-2, B-7, and B-8 at depths between 3 and 4 feet below existing ground surface. Groundwater was not encountered at the Henrietta and Entradero basins. Groundwater elevations typically fluctuate on a seasonal basis due to changes in precipitation, surface runoff, irrigation, pumping, etc. Groundwater should be expected to impact grading/excavations at Amie Basin. At the Henrietta and Entradero basins, grading or construction could be adversely affected by saturated subgrade conditions if performed during or following periods of wet weather.

5.4 Geologic Hazards

From our investigation, it appears that geologic hazards at the site are limited primarily to those caused by strong shaking from earthquake-generated ground motions. Presented here are the geologic hazards that are considered for potential impacts to site development.

5.4.1 Surface Fault Rupture

As defined by the California Geological Survey, an active fault is one that has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). This definition is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Special Studies Zones Act of 1972 and revised in 1994 and 1997 as the Alquist-Priolo Earthquake Fault Zoning Act and Earthquake Fault Hazard Zones. The intent of this act is to require fault investigations on sites located within Earthquake Fault Hazard Zones to preclude new construction of certain habitable structures across the trace of active faults. The sites are not located within or near an Alquist-Priolo Earthquake Fault Zone.

Based on our site reconnaissance and review of the referenced literature, no known active fault traces underlie the sites. Based on our investigation, the potential for surface rupture from displacement or fault movement beneath the proposed improvements is considered low.

5.4.2 Local and Regional Faulting

The California Geological Survey broadly groups faults as "Class A" or "Class B" (Cao et al, 2003). Class A faults are identified based upon relatively well defined paleoseismic activity, and a fault slip rate of more than 5 millimeters per year (mm/yr). In contrast Class B faults have comparatively less defined paleoseismic activity and are considered to have a fault slip rate less than 5 mm/yr. The following Tables 1 thru 3 present the ten nearest active faults to each basin site and include magnitude and fault classification.

TABLE 1 NEAR SITE FAULT PARAMETERS – AMIE BASIN			
FAULT NAME	DISTANCE FROM SITE (mi)	MAXIMUM EARTHQUAKE MAGNITUDE	CLASSIFICATION
Palos Verdes	2.5	7.3	B
Compton Thrust	3.1	6.8	B
Newport-Inglewood (LA Basin)	6.5	7.1	B
Elysian Park Thrust	15.1	6.7	B
Santa Monica	16.5	6.6	B
Malibu Coast	17.0	6.7	B
Hollywood	17.5	6.4	B
Raymond	21.0	6.5	B
Whittier	21.4	6.8	A
Anacapa – Dume	23.5	7.5	B

TABLE 2
NEAR SITE FAULT PARAMETERS – HENRIETTA BASIN

FAULT NAME	DISTANCE FROM SITE (mi)	MAXIMUM EARTHQUAKE MAGNITUDE	CLASSIFICATION
Palos Verdes	2.1	7.3	B
Compton Thrust	3.3	6.8	B
Newport-Inglewood (LA Basin)	7.5	7.1	B
Elysian Park Thrust	15.7	6.7	B
Santa Monica	15.8	6.6	B
Malibu Coast	16.2	6.7	B
Hollywood	17.2	6.4	B
Raymond	21.4	6.5	B
Anacapa – Dume	22.4	7.5	B
Whittier	22.6	6.8	A

TABLE 3 NEAR SITE FAULT PARAMETERS – ENTRADERO BASIN			
FAULT NAME	DISTANCE FROM SITE (mi)	MAXIMUM EARTHQUAKE MAGNITUDE	CLASSIFICATION
Palos Verdes	2.2	7.3	B
Compton Thrust	3.2	6.8	B
Newport-Inglewood (LA Basin)	7.3	7.1	B
Elysian Park Thrust	15.3	6.7	B
Santa Monica	15.3	6.6	B
Malibu Coast	15.7	6.7	B
Hollywood	16.7	6.4	B
Raymond	20.9	6.5	B
Anacapa – Dume	22.1	7.5	B
Whittier	22.4	6.8	A

California Geologic Survey, Probabilistic Seismic Hazards Mapping Ground Motion Page (on line pshamap.asp) indicates ground motions with 10 % probability of exceedance in 50 years for the sites as underlain by alluvium are shown in Tables 4 thru 6.

TABLE 4 SITE GROUND MOTION WITH 10% PROBABILITY OF EXCEEDANCE IN 50 YEARS AMIE BASIN	
PARAMETER	UNIT GRAVITY (alluvium)
Ground Acceleration	0.452
Spectral Acceleration at Short (0.2 second) Duration	1.075
Spectral Acceleration at Long (1.0 second) Duration	0.531

TABLE 5 SITE GROUND MOTION WITH 10% PROBABILITY OF EXCEEDANCE IN 50 YEARS HENRIETTA BASIN	
PARAMETER	UNIT GRAVITY (alluvium)
Ground Acceleration	0.450
Spectral Acceleration at Short (0.2 second) Duration	1.069
Spectral Acceleration at Long (1.0 second) Duration	0.533

TABLE 4 SITE GROUND MOTION WITH 10% PROBABILITY OF EXCEEDANCE IN 50 YEARS ENTRADERO BASIN	
PARAMETER	UNIT GRAVITY (alluvium)
Ground Acceleration	0.446
Spectral Acceleration at Short (0.2 second) Duration	1.061
Spectral Acceleration at Long (1.0 second) Duration	0.527

5.4.3 Liquefaction Evaluation

Liquefaction occurs when saturated fine sands, silts or low plasticity clays lose their physical strength during earthquake-induced shaking and behave as a liquid. This is due to loss of point-to-point grain contact and transfer of normal stress to the pore water. Liquefaction potential varies with groundwater level, soil type, material gradation, relative density, and the intensity and duration of ground shaking. The subject sites are not located in a State of California liquefaction hazard zone (DMG, 1999). Due to cohesive soils encountered at the Amie basin site, liquefaction of site soils should be considered very low. Based on the absence of groundwater in the borings at the Henrietta and Entradero basins, liquefaction of site soils should be considered very low.

5.4.5 Tsunami and Seiche Evaluation

Due to site elevation and distance from the Pacific Ocean, the sites are not considered to be subject to damage from tsunamis. Based on the absence of large bodies of water in the area, seiche (oscillatory waves in standing bodies of water) damage is also not expected.

5.4.6 Landsliding

No evidence of landslides was found to have occurred within the basin sites. However, apparent slope failure was observed on a slope located at the southern end of Entradero Park. Improvements to an existing walking trail located along the top of this slope are part of the proposed development. However, evaluation of this slope and apparent slope failure was not within our scope of work for this report.

5.4.7 Compressible and Expansive Soils

Based on our investigation, encountered site soils consisted of sands and clays with low compressibility characteristics relative to the post-construction overburden. A sample of site soil from each basin was analyzed for expansion index using ASTM designation D 4829. The expansion indexes for the near-surface soil at the Amie, Henrietta, and Entradero basins were 7, 0 and 0, respectively, which indicate a very low expansion potential.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

Based on our investigation, the proposed construction on the sites is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into design and construction of the project. Preliminary recommendations for the design and construction of the proposed development are included in the subsequent sections of this report. Additional recommendations could be required based on the actual conditions encountered during earthwork and/or improvement construction.

6.2 Site Preparation

6.2.1 General

Prior to grading, the sites should be cleared of existing debris and deleterious materials. In areas to receive structures or distress-sensitive improvements, expansive, surficial eroded, desiccated, burrowed, or otherwise loose or disturbed soils should be removed to the depth of competent material. Organic and other deleterious materials not suitable for use as structural backfill should be disposed of offsite at a legal disposal site.

6.2.2 Site Excavations

Temporary, unsurcharged excavations up to four feet deep may be cut vertically. Deeper excavations may be sloped back or shored. Temporary sloped excavations may be cut at a slope of 1:1 (horizontal:vertical) or flatter. Vehicles and storage loads should not be placed within 10 feet of the top of the excavation. If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to divert runoff water from entering the excavation and eroding the slope faces.

6.2.3 Preparation of Areas to Receive Fill

Prior to fill placement, exposed subgrades should be scarified to a depth of 8 inches, brought to slightly above optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

6.2.4 Fill Placement and Compaction

Structural fill and backfill should be compacted to at least 90 percent of the maximum dry density (as determined by ASTM D 1557) at moisture content of optimum or slightly above. The optimum lift thickness for fill soils will be dependent on the type of compaction equipment being utilized. Generally, fill should be placed in uniform horizontal lifts not exceeding 8 inches in loose thickness. Placement and compaction of fill should be performed in general conformance with geotechnical recommendations and local ordinances.

Soils generated from on-site excavations are anticipated to be suitable for use as structural fill, provided they are free from deleterious material. Rocks or other soil fragments greater than four inches in size should not be used in the fills. Proposed import material should be evaluated by the project geotechnical engineer prior to being placed at the site.

6.2.5 Fill Slopes

Fill slopes for the proposed berm at the Entradero basin and other proposed fill slopes / embankments should be constructed at an inclination no steeper than 2:1 (horizontal:vertical). A fill key should be excavated to a minimum depth of 2-feet into competent natural material and a minimum of 15-feet wide at the base of fill slopes. Prior to placing fill material, the exposed base of the key should be scarified and compacted as described in Section 6.2.3. The key should be tipped approximately 2% front to back and this angle should be maintained during the fill slope construction. Fill should be compacted as recommended above (Sec. 6.2.4). Fill slopes should be overbuilt and then trimmed back to grade, exposing the compacted inner core.

6.2.6 Slope Stability

Based on our geotechnical investigation and the recommendations herein, fill slopes constructed at inclinations of 2:1 (horizontal:vertical) or flatter are expected to exhibit factors of safety greater than 1.5.

Although fill slopes on the sites are expected to be grossly and surficially stable, the surficial soils may be susceptible to erosion. Proper drainage measures are imperative for continued favorable performance of slopes. Erosion reducing techniques may also be considered, such as the installation of erosion control fabric onto slope faces and planting of deep-rooted plants requiring little watering.

6.2.7 Utility Trenches

Utility trenches should be excavated as previously discussed (Sec 6.2.2). Utility trench backfill should be placed in loose lifts no greater than eight inches and mechanically compacted to a relative compaction of at least 90 percent, as evaluated by ASTM D 1557.

6.2.8 Dewatering

Perched groundwater was encountered in our soil borings at the Amie Basin site at 3 to 4 feet below existing surface. Groundwater can be expected to be encountered during construction at the Amie basin site. Groundwater was not encountered at the Henrietta and Entradero basin locations. However, groundwater and/or saturated subgrade conditions may be present during construction at these locations, especially during or following periods of heavy precipitation.

If groundwater is encountered during construction, dewatering methods should be used. The type of dewatering method should be selected by the contractor, based on the actual conditions encountered during construction. Saturated conditions due to perched groundwater can likely be dewatered using sump pumps.

6.2.9 Remedial Grading for Future Pump House

Due to the presence of disturbed and loose near-surface materials, remedial grading is recommended for the future pump house at the Amie basin location. The building pad area should be excavated to a depth of approximately 2 feet below existing grade and to a depth that will provide at least 1-foot of engineered fill below the building foundation. The excavation should extend laterally at least 3 feet beyond the limits of the structure foundation.

6.3 Foundations and Slab Recommendations

6.3.1 General

Foundation and slab for the future pump house should be designed in accordance with structural considerations and the following minimum preliminary geotechnical recommendations. Foundations are expected to be supported in properly compacted fill materials. These recommendations assume that the fill soils will have a very low expansion potential.

6.3.2 Shallow Foundations

Following building pad preparation, it is our opinion that the use of isolated and continuous footings or mat foundation will be geotechnically suitable for the future pump house. We recommend that continuous footings be constructed a minimum of 12 inches wide and be founded at least 12 inches below the lowest adjacent rough grade elevation. Mat foundation embedment should be at least 12 inches below lowest adjacent rough grade elevation.

Foundation dimensions should be based on an allowable bearing pressure of 1,000 pounds per square foot (psf) for the minimum footing dimensions noted above. The allowable bearing value may be increased by one-third for short-duration loading which includes the effects of wind or seismic forces.

Mat slab thickness and reinforcement should be determined by the structural engineer, based on expected loading conditions. An uncorrected modulus of subgrade reaction of 30 psi/inch should be used for elastic foundation design, if performed. The compressive strength of the concrete should generally be a minimum of 4500 psi.

Footing reinforcement within continuous footings should consist of a minimum of four number 4 bars, two located at the top of the footing and two located at the bottom. This minimum reinforcement is due to geotechnical conditions and is not to be used in lieu of that needed for structural considerations. Reinforcement for isolated footings should be determined by the structural engineer.

Lateral loads for structures supported on spread footings may be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.30 may be used between foundations or the floor slabs and the supporting soils. The passive resistance of the soils may be assumed equal to the pressure developed by a fluid with a density of 200 pounds per cubic foot. A one-third increase in the passive value may be used for wind or seismic loads. The frictional resistance and the passive resistance may be combined without reduction in determining the total lateral resistance.

6.3.3 Settlement of Foundations

We have analyzed settlement potential during construction and for long-term performance. Construction settlement is expected to occur as loads are applied and structures are brought to their operational weight. Long-term settlement is expected to occur over time as a result of compression of wetted or partially saturated soil. Anticipated settlements are related to an applied bearing pressure for the proposed building of 1,000 psf.

Provided the grading recommendations presented herein are followed, it is anticipated that shallow foundations designed and constructed as recommended will experience maximum total settlement of less than 1 inch and differential static settlement of less than 1/2 inch.

6.3.4 Concrete Slabs-On-Grade

Concrete slab-on-grade for the future pump house should be designed for the anticipated loading. The slab should measure a minimum of 4.5 inches thick and be reinforced with a minimum of number 3 reinforcing bars placed on 18-inch centers, each way at above mid-slab height. The correct placement of the reinforcement in the slab is vital for satisfactory performance under normal conditions. The floor slab and foundations should generally be tied together by extending the slab reinforcement into the footings, or as recommended by the structural engineer.

If there are areas which will receive moisture-sensitive floor covering or be used to store moisture-sensitive materials, a polyethylene or visqueen moisture vapor retarder (10-mil or thicker) should be placed beneath the slab. A two-inch layer of coarse clean sand or compacted aggregate base (either of which should have a Sand Equivalent value of at least 30) should underlie the moisture vapor retarder. To protect the membrane during steel and concrete placement, a maximum two-inch layer of similar material may be placed over the moisture vapor retarder.

It is recommended that a water-cement ratio of 0.5 or less be used for concrete, and that the slab be moist-cured for at least five days in accordance with methods recommended by the American Concrete Institute. On-site quality control should be used to confirm the design conditions.

6.3.5 Pipe Bedding andThrust Blocks

We recommend that pipes be supported on a minimum of 6 inches of sand, gravel, or crushed rock. The pipe bedding material should be placed around the pipe, without voids, and to an elevation of at least 12 inches above the top of the pipe. The pipe bedding material should be compacted in accordance with the recommendations in the earthwork section of this report.

Thrust forces may be resisted by thrust blocks and/or the friction between the pipe and adjacent soil. Thrust blocks may be designed using a passive resistance equal to the pressure developed by a fluid with a density of 200 pounds per cubic foot. A friction value of 0.25 may be used between the pipe and adjacent soil.

6.4 Seismic Design Criteria

The seismic ground motion values listed in the following Table 7 thru 9 were derived in accordance with the International Building Code (IBC), 2009, and the California Building Code (CBC), 2010. This was accomplished by establishing the Site Class based on the soil properties at the site, and then calculating the site coefficients and parameters using the United States Geological Survey (USGS) Java Ground Motion Parameter Calculator – Version 5.1.0 and site coordinates. The site coordinates used are as follows: 33.8454° North latitude, 118.3497° West longitude for Amie Basin; 33.8455° North latitude, 118.3716° West longitude for Henrietta Basin; and 33.8539° North latitude, 118.3722° West longitude for Entradero Basin. These values are intended for the design of structures to resist the effects of earthquake ground motions.

TABLE 7
SEISMIC GROUND MOTION VALUES FOR AMIE BASIN SITE

PARAMETER	VALUE	IBC/CBC REFERENCE
Site Class	D	Table 1613.5.2
Mapped Spectral Response Acceleration Parameter, S_S	1.791g	Figure 1613.5(3)
Mapped Spectral Response Acceleration Parameter, S_1	0.744g	Figure 1613.5(4)
Seismic Coefficient, F_a	1.0	Table 1613.5.3(1)
Seismic Coefficient, F_v	1.5	Table 1613.5.3(2)
MCE Spectral Response Acceleration Parameter, S_{MS}	1.791g	Section 1613.5.3
MCE Spectral Response Acceleration Parameter, S_{M1}	1.116g	Section 1613.5.3
Design Spectral Response Acceleration, Parameter S_{DS}	1.194g	Section 1613.5.4
Design Spectral Response Acceleration, Parameter S_{D1}	0.744g	Section 1613.5.4

TABLE 8 SEISMIC GROUND MOTION VALUES FOR HENRIETTA BASIN SITE		
PARAMETER	VALUE	IBC/CBC REFERENCE
Site Class	D	Table 1613.5.2
Mapped Spectral Response Acceleration Parameter, S_S	1.925g	Figure 1613.5(3)
Mapped Spectral Response Acceleration Parameter, S_1	0.795g	Figure 1613.5(4)
Seismic Coefficient, F_a	1.0	Table 1613.5.3(1)
Seismic Coefficient, F_v	1.5	Table 1613.5.3(2)
MCE Spectral Response Acceleration Parameter, S_{MS}	1.925g	Section 1613.5.3
MCE Spectral Response Acceleration Parameter, S_{M1}	1.192g	Section 1613.5.3
Design Spectral Response Acceleration, Parameter S_{DS}	1.283g	Section 1613.5.4
Design Spectral Response Acceleration, Parameter S_{D1}	0.795g	Section 1613.5.4

TABLE 9
SEISMIC GROUND MOTION VALUES FOR ENTRADERO BASIN SITE

PARAMETER	VALUE	IBC/CBC REFERENCE
Site Class	D	Table 1613.5.2
Mapped Spectral Response Acceleration Parameter, S_S	1.849g	Figure 1613.5(3)
Mapped Spectral Response Acceleration Parameter, S_1	0.773g	Figure 1613.5(4)
Seismic Coefficient, F_a	1.0	Table 1613.5.3(1)
Seismic Coefficient, F_v	1.5	Table 1613.5.3(2)
MCE Spectral Response Acceleration Parameter, S_{MS}	1.849g	Section 1613.5.3
MCE Spectral Response Acceleration Parameter, S_{M1}	1.159g	Section 1613.5.3
Design Spectral Response Acceleration, Parameter S_{DS}	1.233g	Section 1613.5.4
Design Spectral Response Acceleration, Parameter S_{D1}	0.773g	Section 1613.5.4

6.5 Corrosive Soils

Sulfate-containing solutions or soil can have a deleterious effect on the in-service performance of concrete. In order to evaluate the corrosivity of the site soils, a representative sample of site soil from each basin was laboratory tested for pH, resistivity, soluble sulfate and chloride. The results of the tests are summarized below in Table 10.

TABLE 10 SUMMARY OF CHEMICAL ANALYSES				
Sample Location	pH	Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)
B-2 @ 3 – 5 ft. (Amie Basin)	7.7	2600	29	34
B-3 @ 4 – 5 ft. (Henrietta Basin)	6.4	16000	ND*	23
B-6 @ 2 – 4 ft. (Entradero Basin)	6.2	9000	14	19

* ND - Not Detected

Based on ACI 18 Building Code and Commentary Table 4.3.1, a sulfate exposures of 14 to 29 ppm is considered *negligible*. We recommend that Type II modified cement be used. We further recommend that at least a 3-inch thick concrete cover be maintained over the reinforcing steel in concrete in contact with the soil.

Based on the results of the resistivity test, site soils appear to be *moderately* to *mildy* corrosive to ferrous metals. We recommend plastic pipes be used or cathodic protection for metal pipes. CTE does not practice in the field of corrosion engineering. Therefore, a corrosion engineer could be consulted to determine the appropriate protection, if any, for metallic improvements in contact with site soils.

6.6 Infiltration Test Results

Infiltration test results are presented below in Table 11.

TABLE 11
INFILTRATION TEST RESULTS

Infiltration Test No. /Basin Location	Depth of Test	Soil Description (USCS Symbol)	Infiltration Rate (cm / hr)
IT-1 / Amie	Ground surface	Silty Clayey Sand (SC-SM)	0.21
IT-2 / Amie	Ground surface	Silty Clayey Sand (SC-SM)	0.21
IT-3 / Henrietta	Ground surface	Silty Sand (SM)	3.15
IT-4 / Henrietta	Ground surface	Sand with Silt (SP-SM)	7.62
IT-5 / Entradero	Ground surface	Silty Sand (SM)	3.63
IT-6 / Entradero	Ground surface	Silty Sand (SM)	2.88

6.7 Drainage

Positive drainage should be established around site structures and is defined as drainage away from structures and improvements as recommended by the project civil engineer of record. The project civil engineer should thoroughly evaluate the on-site drainage and make provisions as necessary to keep surface water from entering structural areas.

6.8 Plan Review

CTE should be authorized to review project grading and foundation plans and the project specifications before the start of earthwork to identify potential conflicts with the recommendations contained in this report.

7.0 LIMITATIONS

The recommendations provided in this report are based on the anticipated construction and the subsurface conditions found in our explorations. The interpolated subsurface conditions should be checked in the field during construction to document that conditions are as anticipated.

Recommendations provided in this report are based on the understanding and assumption that CTE will provide the observation and testing services for the project. Earthwork should be observed and tested to document that grading activity has been performed according to the recommendations contained within this report. The project geotechnical engineer should evaluate foundation excavations prior to placement of reinforcing steel.

The field evaluation, laboratory testing and geotechnical analysis presented in this report have been conducted according to current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations and opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is applicable to the site for a period of three years after the issue date provided the project remains as described herein. Modifications to the standard of practice and regulatory requirements may necessitate an update to this report prior to the three years from issue.

Our conclusions and recommendations are based on an analysis of the observed conditions. If conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if required, will be provided upon request. CTE should review project specifications for earthwork, foundation, and shoring-related activities prior to the solicitation of construction bids.

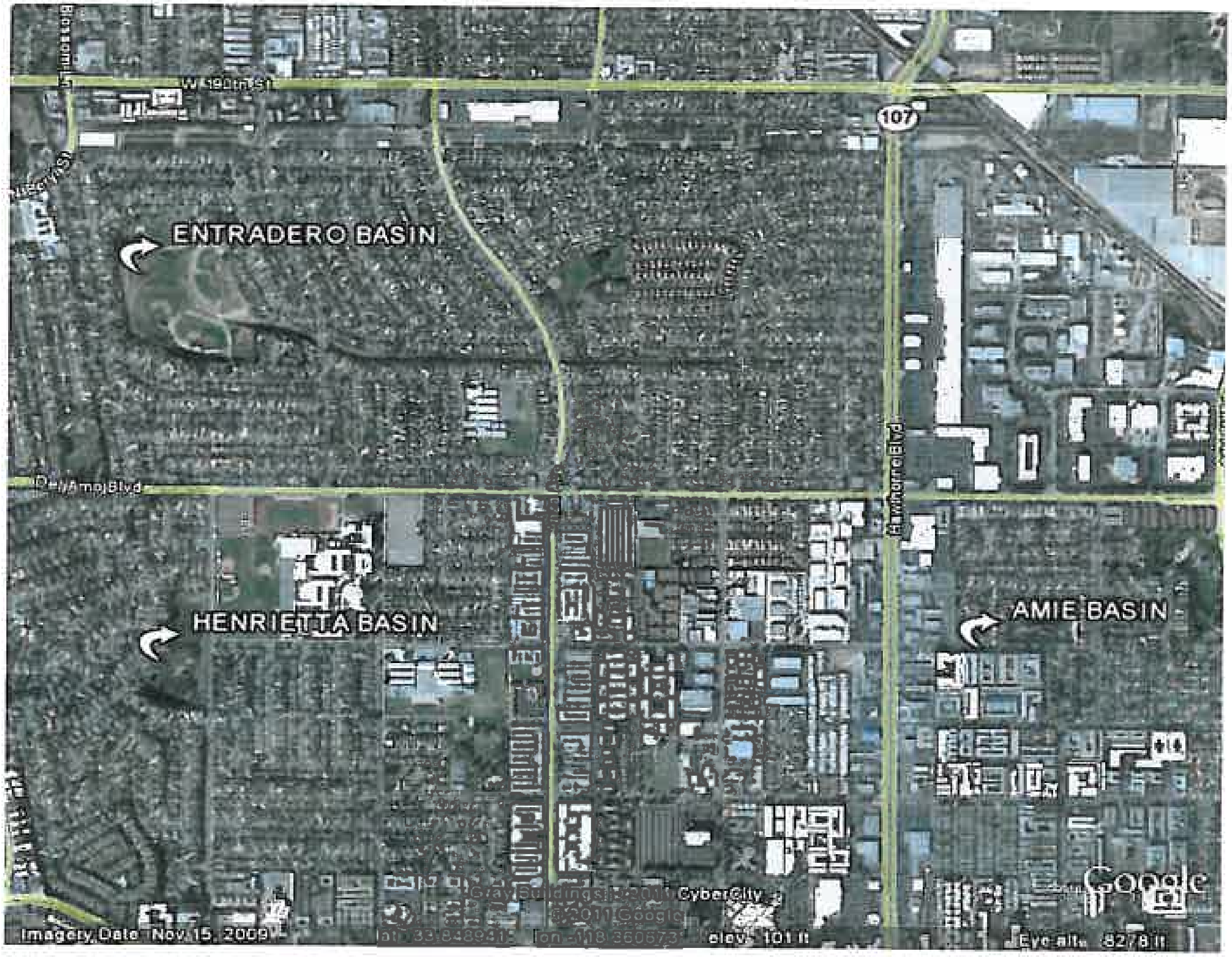
We appreciate this opportunity to be of service on this project. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, INC.

Clifford A. Craft, GE #243
Senior Geotechnical Engineer

Vincent J. Patula, CEG #2057
Senior Engineering Geologist

Robert L. Ellerbusch
Staff Geologist



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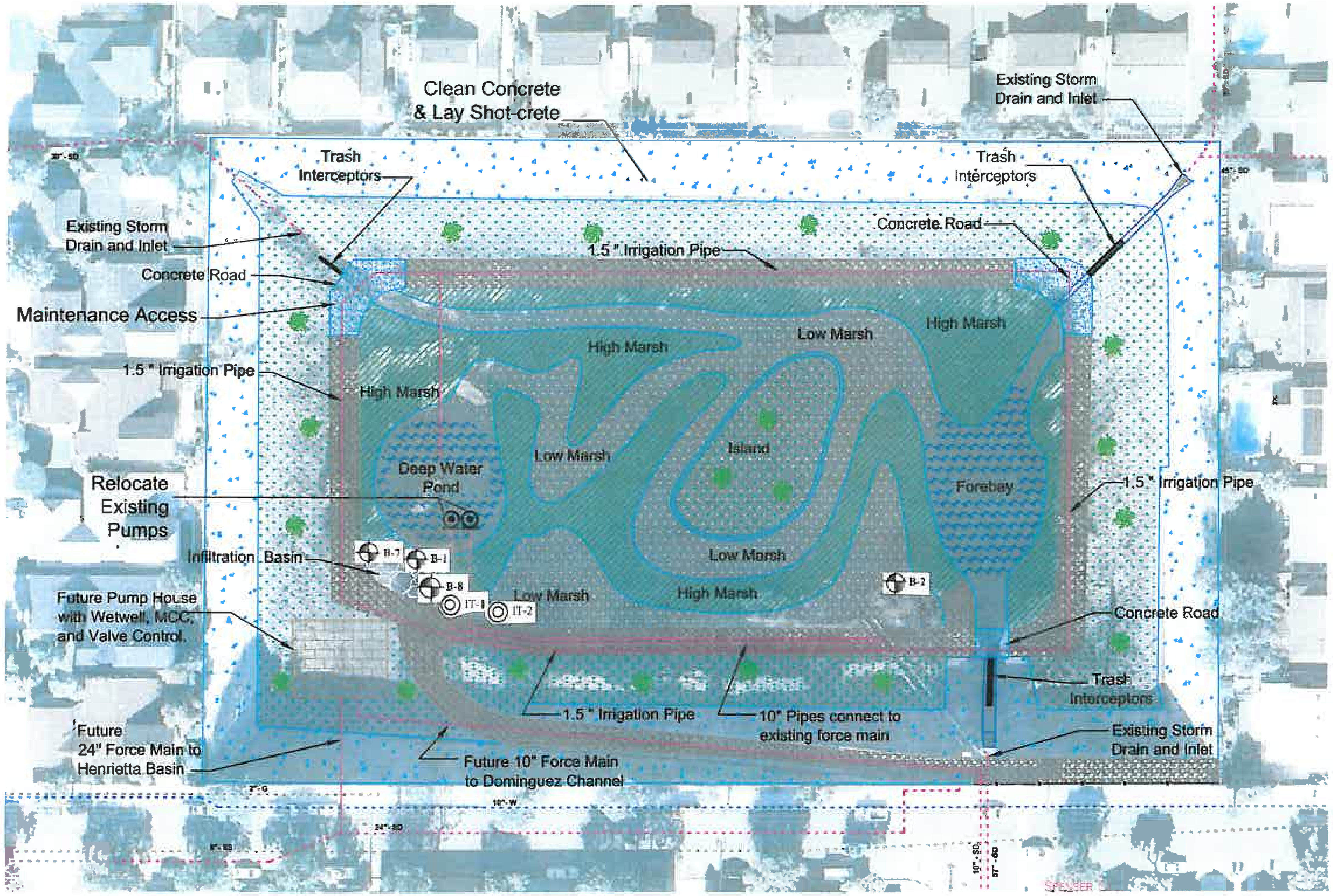
SCALE 1" ~ 1300'

CONSTRUCTION TESTING & ENGINEERING, INC.

SITE LOCATION MAP STORMWATER BASIN ENHANCEMENT PROJECT TORRANCE, CALIFORNIA		
Job No.	Date	Figure
40-2685	MAY 2011	1



LEGEND

- High Marsh
- Low Marsh
- Landscape
- Trees
- Crushed Aggregate
- Infiltration Gravel
- Proposed Pipe
- Pump

0 15' 30' 60'

NORTH

APPENDIX A
FIGURE A-1
AMIE BASIN
CONCEPTUAL DESIGN

GEOTECHNICAL LEGEND

B-1 APPROX. BORING LOCATION

IT-1 APPROX. INFILTRATION TEST LOCATION

PLANS PREPARED BY:

Carollo Engineers

10540 Talbert Avenue, Suite 200
Fountain Valley, California 92708
Tel: (714) 593-5100
Fax: (714) 593-5101

REV.	DATE	DESCRIPTION	BY	CHECKED

CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

DRAWN:
DESIGNED:
PROJECT ENGINEER:
PROJECT MANAGER:

APPROVED:
CRAIG BILEZERIAN DATE
CITY ENGINEER
R.C.E. NO.55339 EXP. 12/31/08

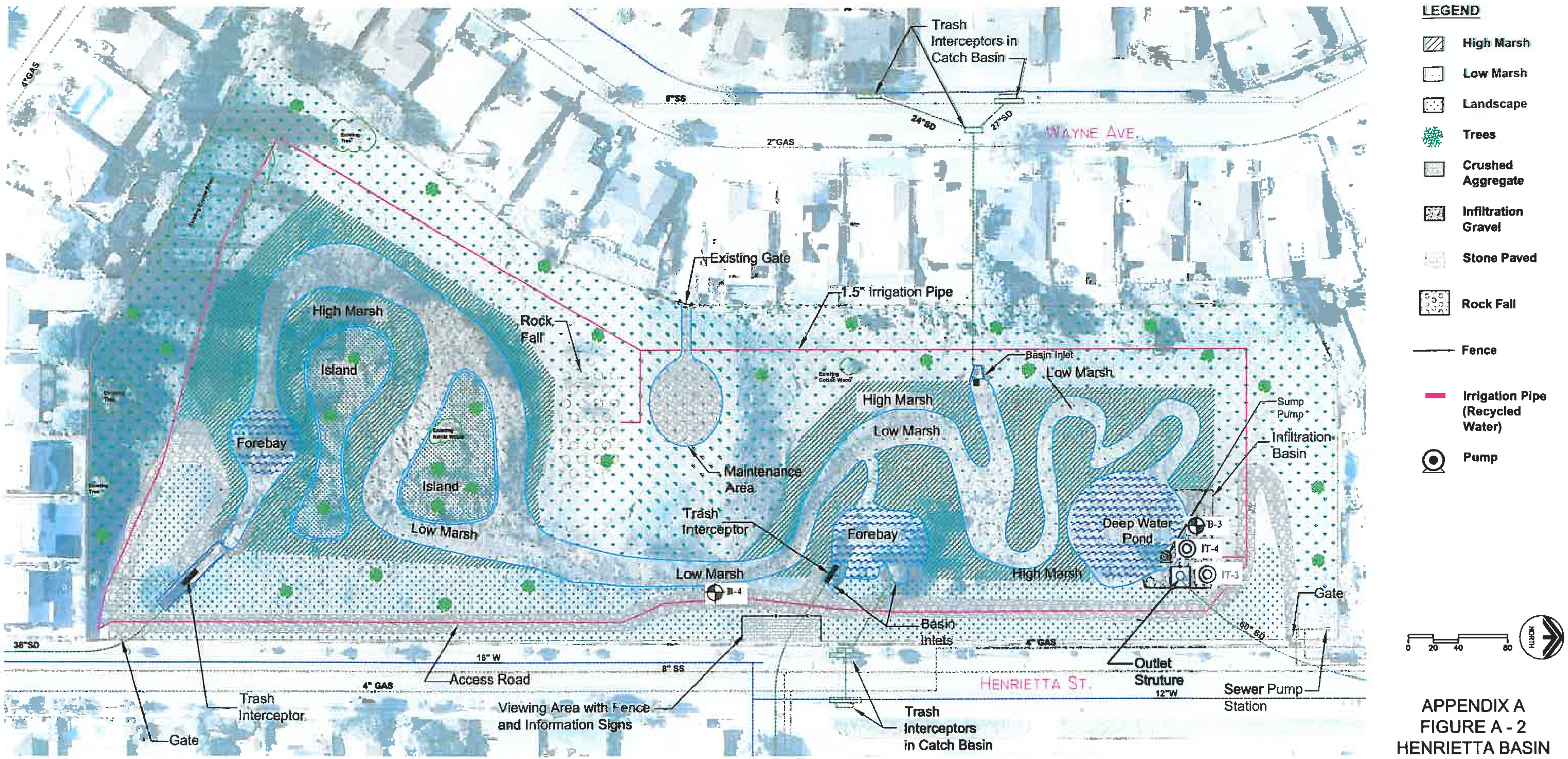
SCALE: AS SHOWN SHEET OF

PLAN NO.

CONSTRUCTION TESTING & ENGINEERING, INC.

EXPLORATION AND TEST LOCATION MAP
AMIE BASIN
TORRANCE, CALIFORNIA

Job No.	Date	Figure
40-2685	MAY 2011	2A



APPENDIX A
FIGURE A - 2
HENRIETTA BASIN
CONCEPTUAL DESIGN

GEOTECHNICAL LEGEND

B-3 APPROX. BORING LOCATION

IT-3 APPROX. INFILTRATION TEST LOCATION

PLANS PREPARED BY:
Carollo
Engineers...Working Wonders With Water™
10540 Talbert Avenue, Suite 200
Fountain Valley, California 92708
Tel: (714) 593-5100
Fax: (714) 593-5101

REV.	DATE	DESCRIPTION	BY	CHECKED

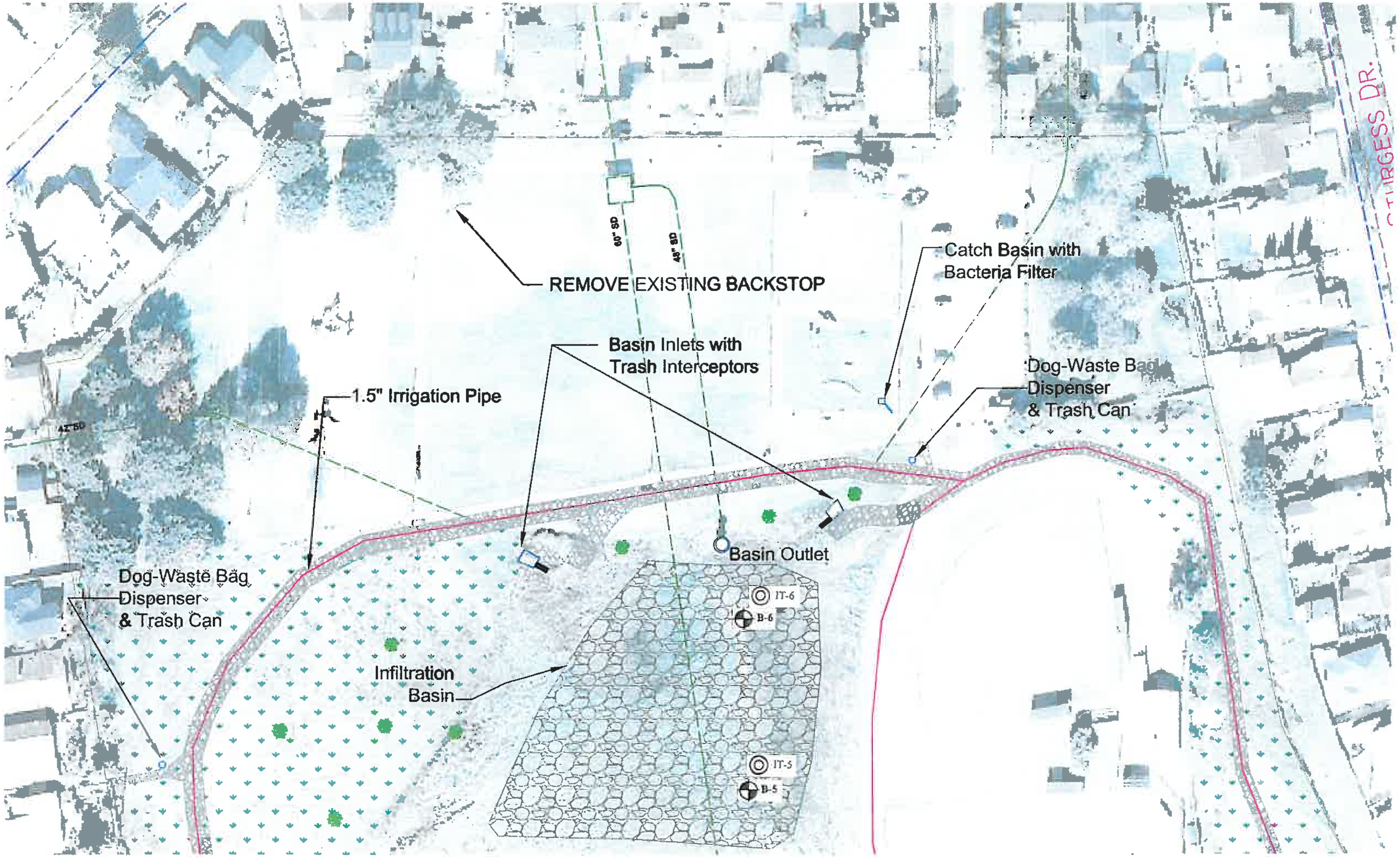
CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

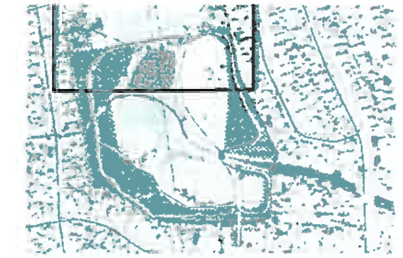
DRAWN:
DESIGNED:
PROJECT ENGINEER:
PROJECT MANAGER:
APPROVED:
CRAIG BILEZERIAN
CITY ENGINEER
R.C.E. NO.55339
DATE
EXP. 12/31/08
SCALE: AS SHOWN SHEET ___ OF ___
PLAN NO.

CONSTRUCTION TESTING & ENGINEERING, INC.

EXPLORATION AND TEST LOCATION MAP
HENRIETTA BASIN
TORRANCE, CALIFORNIA

Job No.	Date	Figure
40-2685	MAY 2011	2B





LEGEND

- Landscape
- Trees
- Dog Waste Bag Dispenser
- Crushed Aggregate
- Infiltration Gravel
- Berm
- Irrigation Pipe (Recycled Water)

NORTH

0 20' 40' 80'

APPENDIX A
FIGURE A - 3
NORTH ENTRADERO BASIN
CONCEPTUAL DESIGN

GEOTECHNICAL LEGEND

B-5 APPROX. BORING LOCATION

IT-5 APPROX. INFILTRATION TEST LOCATION

PLANS PREPARED BY:

Carollo Engineers

10540 Talbert Avenue, Suite 200
Fountain Valley, California 92708
Tel: (714) 593-5100
Fax: (714) 593-5101

REV.	DATE	DESCRIPTION	BY	CHECKED

CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

DRAWN:
DESIGNED:
PROJECT ENGINEER:
PROJECT MANAGER:
APPROVED:
CRAIG BILEZERIAN, CITY ENGINEER, R.C.E. NO.55339 — DATE — EXP. 12/31/08
SCALE: AS SHOWN — SHEET ___ OF ___
PLAN NO.

CONSTRUCTION TESTING & ENGINEERING, INC.

EXPLORATION AND TEST LOCATION MAP
ENTRADERO BASIN
TORRANCE, CALIFORNIA

Job No.	Date	Figure
40-2685	MAY 2011	2C

APPENDIX A

REFERENCES

REFERENCES

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3. California Department of Conservation, Division of Mines and Geology (DMG), 1999, State of California Seismic Hazard Zones, Torrance Quadrangle, Official Map, Released March 25.

4. County of Los Angeles, Department of Public Works, 2011, Low Impact Development Best Management Practice Guideline for Design, Investigation, and Reporting, dated January 3.

5. Hart, Earl W. and Bryant, W.A., Revised 1997, "Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps," California Division of Mines and Geology, Special Publication 42.

6. International Building Code, 2009 Edition.

7. Saucedo, George J., et al, 2003, Geologic Map of the Long Beach 30'x 60' Quadrangle, California, Regional Geologic Map Series, Scale 1:100000.

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APPENDIX B

FIELD EXPLORATION METHODS AND EXPLORATION LOGS

APPENDIX B

FIELD EXPLORATION METHODS AND EXPLORATION LOGS

Soil Boring Methods

Relatively "Undisturbed" Soil Samples

Relatively "undisturbed" soil samples were collected using a modified California-drive sampler (2.4-inch inside diameter, 3-inch outside diameter) lined with sample rings. Drive sampling was conducted in general accordance with ASTM D-3550. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column "Blows/Foot." The soil was retained in brass rings (2.4 inches in diameter, 1.00 inch in height). The samples were retained and carefully sealed in waterproof plastic containers for shipment to the Construction Testing & Engineering ("CTE") geotechnical laboratory.

Disturbed Soil Sampling

Bulk soil samples were collected for laboratory analysis using two methods. Standard Penetration Tests (SPT) were performed according to ASTM D-1586 at selected depths in the borings using a standard (1.4-inches inside diameter, 2-inches outside diameter) split-barrel sampler. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column "Blows/Foot." Samples collected in this manner were placed in sealed plastic bags. Bulk soil samples of the drill cuttings were also collected in large plastic bags. All disturbed soil samples were returned to the CTE geotechnical laboratory for analysis.

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DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS < 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OF NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS < 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, SLIGHTLY PLASTIC CLAYEY SILTS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTS OR LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

BOULDERS	COBBLES	GRAVEL		SAND			SILTS AND CLAYS
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" 4 10 40 200

CLEAR SQUARE SIEVE OPENING U.S. STANDARD SIEVE SIZE

ADDITIONAL TESTS

(OTHER THAN TEST PIT AND BORING LOG COLUMN HEADINGS)

MAX- Maximum Dry Density
GS- Grain Size Distribution
SE- Sand Equivalent
EI- Expansion Index
CHM- Sulfate and Chloride Content , pH, Resistivity
COR - Corrosivity
SD- Sample Disturbed

PM- Permeability
SG- Specific Gravity
HA- Hydrometer Analysis
AL- Atterberg Limits
RV- R-Value
CN- Consolidation
CP- Collapse Potential
HC- Hydrocollapse
REM- Remolded

PP- Pocket Penetrometer
WA- Wash Analysis
DS- Direct Shear
UC- Unconfined Compression
MD- Moisture/Density
M- Moisture
SC- Swell Compression
OI- Organic Impurities

FIGURE: BL1

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PROJECT:	DRILLER:	SHEET: of
CTE JOB NO:	DRILL METHOD:	DRILLING DATE:
LOGGED BY:	SAMPLE METHOD:	ELEVATION:

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	BORING LEGEND DESCRIPTION	Laboratory Tests
0								Block or Chunk Sample	
								Bulk Sample	
5									
								Standard Penetration Test	
10								Modified Split-Barrel Drive Sampler (Cal Sampler)	
								Thin Walled Army Corp. of Engineers Sample	
15								Groundwater Table	
								Soil Type or Classification Change	
20								? —— ? —— ? —— ? —— ? —— ? —— ? — Formation Change [(Approximate boundaries queried (?)]	
25						"SM"		Quotes are placed around classifications where the soils exist in situ as bedrock	

FIGURE: BL2

CONSTRUCTION TESTING & ENGINEERING, INC.

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 34' msl

BORING: B-1

Depth (Feet)	Bulk Sample	Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						GP		**Artificial Fill** Miscellaneous base material	
						SC-SM		**Old Alluvial Flood Plain Deposits (Qoa)**	
			5 3 4		27.0			Silty Clayey SAND, loose, wet, dark gray	WA (31% pass #200) M
								*Perched Groundwater encountered at 4 ft.	
5			7 12 12	87.1	39.6	CH		Fat CLAY with Sand, very stiff, very moist, dark gray laminations, moderate iron-oxide staining	WA (72% pass #200) MD
10			3 4 5		37.5			Fat CLAY, stiff, very moist, dark gray	AL (LL=57, PI=31) M
15			11 38 50	101.0	7.2	SP-SM		Poorly-graded SAND with Silt, very dense, moist, light brown	WA (12% pass #200) MD
20			5 13 18		9.0			Poorly-graded SAND with Silt, dense, moist, light brown	M
25						SP-SM			

CONSTRUCTION TESTING & ENGINEERING, INC.

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 34' msl

BORING: B-1 Cont'd

Depth (Feet)	Bulk Sample	Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25			22			SP-SM			
			32			ML		Sandy SILT, hard, moist, light brown	
			50	104.1	9.4				MD
								Total Depth = 26.5 ft. Perched Groundwater encountered at 4 ft. below ground surface. Bore hole backfilled with soil cuttings.	
30									
35									
40									
45									
50									

B-1b

CONSTRUCTION TESTING & ENGINEERING, INC.

14538 Meridian Parkway, Suite A | Riverside, CA 92518 | 951.571.4081 | Fax 951.571.4188

PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 31' msl

BORING: B-2

Depth (Feet)	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0				SC-SM	**Artificial Fill** Silty Clayey SAND, very moist, gray	
	2 1 1		18.0	SC-SM	**Old Alluvial Flood Plain Deposits (Qoa)** Silty Clayey SAND, very loose, wet, dark gray *Perched Groundwater encountered at 3 ft.	WA (25% pass #200) M CHM
5	1 2 2	100.6	18.9		Silty Clayey SAND, very loose, wet, dark gray	WA (27% pass #200) MD, DS EI
10	push		23.4		Silty Clayey SAND, very loose, wet, dark gray	M
15	2 3 5				No recovery Silty Clayey SAND, loose, wet, dark gray, as observed from soil cuttings.	
20	2 8 15		27.1	ML	Sandy SILT, very stiff, very moist, light brown	M
25				SC-SM		

B-2

Boring B-2

CONSTRUCTION TESTING & ENGINEERING, INC.

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 31' msl

BORING: B-2 Cont'd

Depth (Feet)	Bulk Sample	Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25			50/4"	104.6	21.6	SC-SM		Silty Clayey SAND, very dense, very moist, dark gray	MD
								Total Depth = 25.5 ft. Perched Groundwater encountered at 3 ft. below ground surface. Bore hole backfilled with soil cuttings.	
30									
35									
40									
45									
50									

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 52' msl

BORING: B-3

Depth (Feet)	Sample: Bulk / Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0					SP-SM	**Young Alluvial Flood Plain Deposits (Qya)**	
	Driven	3 4 5		11.9		Poorly-graded SAND with Silt, loose, moist, light brown	WA (10% pass #200) M
	Bulk						CHM
5	Driven	8 11 18	100.9	19.8	SM	Silty SAND, medium dense, very moist, light brown	WA (16% pass #200) MD EI
10	Driven	6 10 17		9.7	SP-SM	Poorly-graded SAND with Silt, medium dense, moist, light brown	M
15	Driven	23 50	93.7	10.8	SM	Silty SAND, very dense, moist, light brown faint iron-oxide staining	MD
20	Driven	8 13 18		12.0		Silty SAND, dense, moist, light brown faint iron-oxide staining	M
						Total Depth = 21.5 ft. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
25							

CONSTRUCTION TESTING & ENGINEERING, INC.

PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 58' msl

BORING: B-4

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0						SM	**Young Alluvial Flood Plain Deposits (Qya)** Silty SAND, moist, brown	
5			5 8 13	93.0	11.4		Silty SAND, medium dense, moist, light brown	WA (16% pass #200) MD, DS
10			5 9 10		4.1		Silty SAND, medium dense, damp, light brown faint iron-oxide staining	M
15			22 35 44	101.4	4.5		Silty SAND, very dense, damp, light brown faint iron-oxide staining	MD
20			5 11 14		6.0		Silty SAND, medium dense, moist, light gray-brown	M
							Total Depth = 21.5 ft. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
25								

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 66' msl

BORING: B-5

Depth (Feet)	Bulk Sample	Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Young Alluvial Flood Plain Deposits (Qya)**	
			4 10 14		12.1			Silty SAND, medium dense, moist, brown	WA (22% pass #200) M
5			7 9 12	97.9	16.1	SP-SM		Poorly-graded SAND with Silt, medium dense, very moist, light brown	WA (7% pass #200) MD
10			3 4 5		13.1	SM		Silty SAND, loose, moist, light brown	M
15			12 30 44	92.5	11.6			Silty SAND, very dense, moist, light brown faint iron-oxide staining	MD
20			6 12 12		11.7			Silty SAND, medium dense, moist, light brown faint iron-oxide staining	M
								Total Depth = 21.5 ft. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
25									

Boring B-5

CONSTRUCTION TESTING & ENGINEERING, INC.

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 64' msl

BORING: B-6

Depth (Feet)	Bulk Sample	Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Young Alluvial Flood Plain Deposits (Qya)**	
			11 14 22	98.5	16.0			Silty SAND, dense, moist, brown	WA (31% pass #200) MD CHM
5			3 3 4		18.3	SP-SM		Poorly-graded SAND with Silt, loose, very moist, light brown	EI M
10			9 15 20	99.5	14.2	SM		Silty SAND, dense, moist, light brown	WA (20% pass #200) MD
15			5 9 12		13.1			Silty SAND, medium dense, moist, light brown	M
20			22 50	92.3	14.7			Silty SAND, very dense, moist, light brown	MD
								Total Depth = 21 ft. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
25									

CONSTRUCTION TESTING & ENGINEERING, INC.

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PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~36' msl

BORING: B-7

Depth (Feet)	Bulk Sample	Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						GP		**Artificial Fill** Miscellaneous base material	
						SC-SM		**Old Alluvial Flood Plain Deposits (Qoa)** Silty Clayey SAND, very moist to wet, brown change to dark gray at 2 ft. *Groundwater encountered at 4 ft.	
5								Total Depth = 5 ft. Groundwater encountered at 4 ft. below ground surface. Bore hole backfilled with soil cuttings.	
10									
15									
20									
25									

CONSTRUCTION TESTING & ENGINEERING, INC.

PROJECT:	Stormwater Basin Enhancement Project	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-2685	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/19/2011
LOGGED BY:	R. Ellerbusch	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~ 35' msl

BORING: B-8

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6"	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SC-SM		**Old Alluvial Flood Plain Deposits (Qoa)**	
								Silty Clayey SAND, very moist to wet, brown	
								change to dark gray at 2 ft.	
								*Groundwater encountered at 3 ft.	
5								Total Depth = 4 ft. Groundwater encountered at 4 ft. below ground surface. Bore hole backfilled with soil cuttings.	
10									
15									
20									
25									

APPENDIX C

LABORATORY METHODS AND RESULTS

APPENDIX C
LABORATORY METHODS AND RESULTS

Laboratory tests were performed on selected soil samples to evaluate their engineering properties. Tests were performed following test methods of the American Society for Testing and Materials, or other accepted standards. The following presents a brief description of the various test methods used. Laboratory results are presented in the following section of this Appendix.

Chemical Analysis

Soil materials were collected and tested for Sulfate and Chloride content, pH, and Resistivity.

Classification

Soils were classified visually according to the Unified Soil Classification System. Visual classifications were supplemented by laboratory testing of selected samples according to ASTM D 2487.

Direct Shear

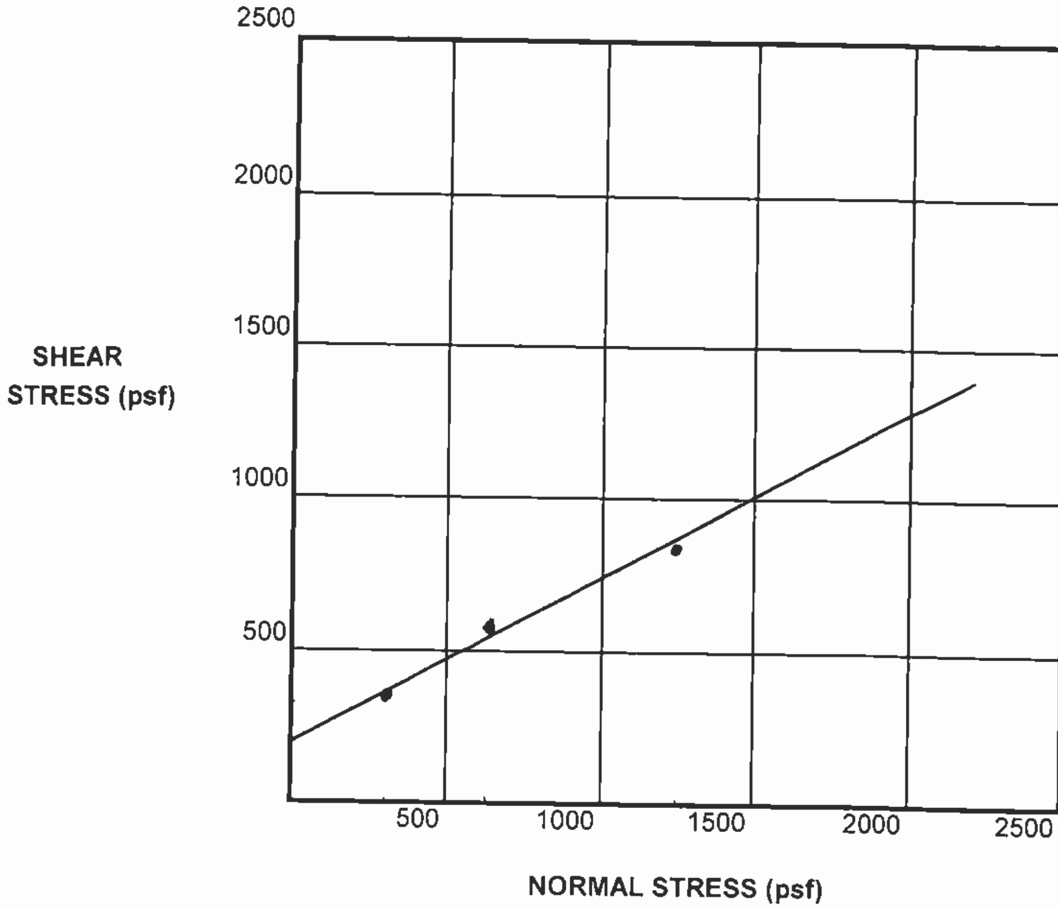
Direct shear tests were performed on relatively undisturbed samples. Direct shear testing was performed in accordance with ASTM D 3080. The samples were inundated during shearing to represent adverse field conditions.

Expansion Index

Expansion testing was performed on selected samples of the on-site soils according to ASTM D 4829.

In-Place Moisture/Density

The in-place moisture content and dry unit weight of selected samples were determined using relatively undisturbed soil samples.



SHEAR STRENGTH TEST				
Job No.	Location/ Depth	Cohesion (psf)	Friction Angle	Sample Descript.
40-2685	B-2 5 ft.	200	28°	Clayey Sand undisturbed 100.6 pcf @ 18.9% wc

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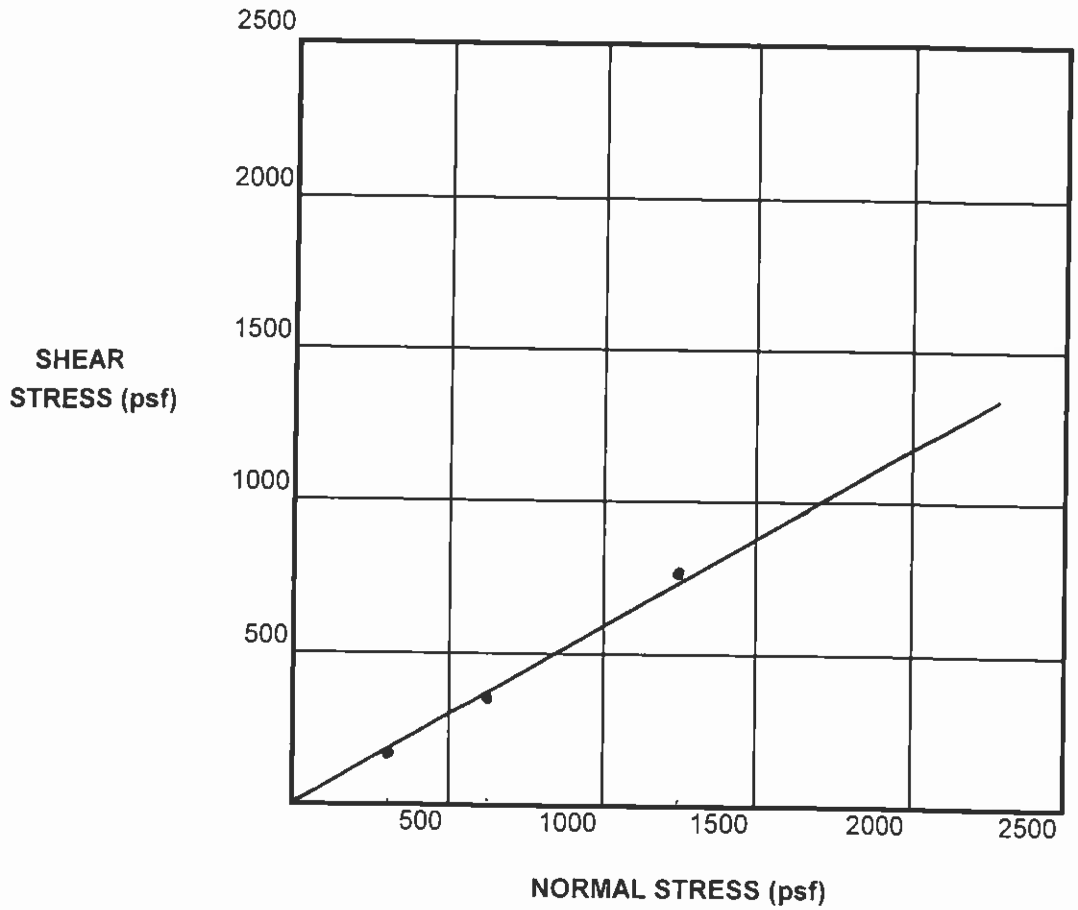

SHEAR STRENGTH TEST				
Job No.	Location/ Depth	Cohesion (psf)	Friction Angle	Sample Descript.
40-2685	B-4 5 ft.	0	30°	Silty Sand undisturbed 93.0 pcf 11.4% wc

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EXPANSION INDEX TEST

ASTM D 4829

CTE Project Number: **40-2685**

Project Name: **Stormwater Basin Enhancement**

Location: B-2 @ 5-8 ft. (Amie Basin)

Test Start Date: 4-26-11	Time: 8:00 am	Initial Reading: 0.0051
Test Finish Date: 4-27-11	Time: 8:00 am	Final Reading: 0.0566

Specimen Moisture Content: 8.7%
Specimen Dry Density: 108.6 pcf
Specimen Percent Saturation: 50 %

Expansion (inches): 0.0515

Expansion Index: **7**

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EXPANSION INDEX TEST

ASTM D 4829

CTE Project Number: **40-2685**

Project Name: **Stormwater Basin Enhancement**

Location: B-3 @ 5-8 ft. (Henrietta Basin)

Test Start Date: 4-27-11	Time: 8:30 am	Initial Reading: 0.0020
Test Finish Date: 4-28-11	Time: 8:300 am	Final Reading: 0.0020

Specimen Moisture Content: 8.6%
Specimen Dry Density: 111.2 pcf
Specimen Percent Saturation: 48 %

Expansion (inches): 0.0000

Expansion Index: **0**

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EXPANSION INDEX TEST

ASTM D 4829

CTE Project Number: **40-2685**

Project Name: **Stormwater Basin Enhancement**

Location: B-6 @ 4-7 ft. (Entradero Basin)

Test Start Date: 4-28-11	Time: 9.00 am	Initial Reading: 0.0054
Test Finish Date: 4-29-11	Time: 9:00 am	Final Reading: 0.0054

Specimen Moisture Content: 9.0%
Specimen Dry Density: 109.5 pcf
Specimen Percent Saturation: 48 %

Expansion (inches): 0.0000

Expansion Index: **0**

E.S.BABCOCK&Sons,Inc.
Environmental Laboratories est 1906

Client Name:	Construction Testing & Eng., Inc.	Analytical Report:	Page 1 of 5
Contact:	Robert Ellerbusch	Project Name:	Const. Test.-Soils
Address:	14538 Meridian Parkway, Suite A Riverside, CA 92518	Project Number:	40-2685 Torrance, CA
		Work Order Number:	**A1D1769**
Report Date:	02-May-2011	Received on Ice (Y/N):	No Temp: °C

Attached is the analytical report for the sample(s) received for your project. Below is a list of the individual sample descriptions with the corresponding laboratory number(s). Also, enclosed is a copy of the Chain of Custody document (if received with your sample(s)). Please note any unused portion of the sample(s) may be responsibly discarded after 30 days from the above report date, unless you have requested otherwise.

Thank you for the opportunity to serve your analytical needs. If you have any questions or concerns regarding this report please contact our client service department.

Sample Identification

Lab Sample #	Client Sample ID	Matrix	Date Sampled	By	Date Submitted	By
A1D1769-01	40-2685: B-2 @ 3-5' Stormwater Basin Enhancement	Soil	04/19/11 08:00	Robert Ellerbusc	04/19/11 16:35	R. Ellerbusch
A1D1769-02	40-2685: B-3 @ 4-5' Stormwater Basin Enhancement	Soil	04/19/11 11:00	Robert Ellerbusc	04/19/11 16:35	R. Ellerbusch
A1D1769-03	40-2685: B-6 @ 2-4' Stormwater Basin Enhancement	Soil	04/19/11 13:30	Robert Ellerbusc	04/19/11 16:35	R. Ellerbusch

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Environmental Laboratories est 1906

Client Name: Construction Testing & Eng., Inc.
Contact: Robert Ellerbusch
Address: 14538 Meridian Parkway, Suite A
Riverside, CA 92518

Report Date: 02-May-2011

Project Name: Const. Test.-Soils
Project Number: 40-2685 Torrance, CA

Work Order Number: A1D1769
Received on Ice (Y/N): No Temp: °C

Laboratory Reference Number
A1D1769-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
40-2685: B-2 @ 3-5' Stormwater Basin Enhancement	Soil	04/19/11 08:00	04/19/11 16:35

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Saturated Paste							
pH	7.7	0.1	pH Units	S-1.10 W.S.	04/27/11 15:10	hgg	
Minimum Resistivity	2600	10	ohm-cm	Cal Trans 643	04/28/11 15:10	hgg	
Water Extract							
Chloride	34	10	ppm	Ion Chromat.	04/27/11 02:38	ss	N-SAG, N_WEX
Sulfate	29	10	ppm	Ion Chromat.	04/27/11 02:38	ss	N-SAG, N_WEX

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NELAP no. 02101CA
CA Elap no. 2698
EPA no. CA00102

E.S.BABCOCK&Sons,Inc.
Environmental Laboratories est 1906

Client Name: Construction Testing & Eng., Inc.
Contact: Robert Ellerbusch
Address: 14538 Meridian Parkway, Suite A
Riverside, CA 92518

Report Date: 02-May-2011

Project Name: Const. Test.-Soils
Project Number: 40-2685 Torrance, CA

Work Order Number: A1D1769

Received on Ice (Y/N): No Temp: °C

Laboratory Reference Number

A1D1769-02

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
40-2685: B-3 @ 4-5' Stormwater Basin Enhancement	Soil	04/19/11 11:00	04/19/11 16:35

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Saturated Paste							
pH	6.4	0.1	pH Units	S-1.10 W.S.	04/27/11 15:10	hgg	
Minimum Resistivity	16000	10	ohm-cm	Cal Trans 643	04/28/11 15:10	hgg	
Water Extract							
Chloride	23	10	ppm	Ion Chromat.	04/27/11 02:49	ss	N-SAG, N_WEX
Sulfate	ND	10	ppm	Ion Chromat.	04/27/11 02:49	ss	N-SAG, N_WEX

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location
6100 Quail Valley Court
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NELAP no. 02101CA
CA Elap no. 2698
EPA no. CA00102

E.S.BABCOCK&Sons,Inc.
Environmental Laboratories est 1906

Client Name: Construction Testing & Eng., Inc.
Contact: Robert Ellerbusch
Address: 14538 Meridian Parkway, Suite A
Riverside, CA 92518

Report Date: 02-May-2011

Project Name: Const. Test.-Soils
Project Number: 40-2685 Torrance, CA

Work Order Number: A1D1769
Received on Ice (Y/N): No Temp: °C

Laboratory Reference Number
A1D1769-03

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
40-2685: B-6 @ 2-4' Stormwater Basin Enhancement	Soil	04/19/11 13:30	04/19/11 16:35

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Saturated Paste							
pH	6.2	0.1	pH Units	S-1.10 W.S.	04/27/11 15:10	hgg	
Minimum Resistivity	9000	10	ohm-cm	Cal Trans 643	04/28/11 15:10	hgg	
Water Extract							
Chloride	19	10	ppm	Ion Chromat.	04/27/11 03:00	ss	N-SAG, N_WEX
Sulfate	14	10	ppm	Ion Chromat.	04/27/11 03:00	ss	N-SAG, N_WEX

Client Name: Construction Testing & Eng., Inc.
Contact: Robert Ellerbusch
Address: 14538 Meridian Parkway, Suite A
Riverside, CA 92518

Report Date: 02-May-2011

Project Name: Const. Test.-Soils
Project Number: 40-2685 Torrance, CA

Work Order Number: A1D1769
Received on Ice (Y/N): No Temp: °C

Notes and Definitions

N_WEX Analyte determined on a 1:10 water extract from the sample.

N-SAG Results reported in ppm are expressed on an air dried soil basis.

ND: Analyte NOT DETECTED at or above the Method Detection Limit **(if MDL is reported)**, otherwise at or above the Reportable Detection Limit (RDL)

NR: Not Reported

RDL: Reportable Detection Limit

MDL: Method Detection Limit

* / (Non-NELAP): NELAP does not offer accreditation for this analyte/method/matrix combination

Approval

Enclosed are the analytical results for the submitted sample(s). Babcock Laboratories certify the data presented as part of this report meet the minimum quality standards in the referenced analytical methods. Any exceptions have been noted. Babcock Laboratories and its officers and employees assume no responsibility and make no warranty, express or implied, for uses or interpretations made by any recipients, intended or unintended, of this report.

Justin C. Troup

Digitally signed by Justin Troup - Project Manager
Date: 2011.05.02 14:09:24 -07'00'

cc:

e-Short.rpt